IN THE CLAIMS:

Claims 16 – 20, 41 – 48, 61, 62, 67 and 68 have been cancelled.

Claims 1 - 10 (cancelled).

11. (original) A stereo echo canceller associated to a space provided therein with two loudspeakers and two microphones for forming four audio transfer systems through which stereo sounds are reproduced by said respective loudspeakers and are collected by said respective microphones,

the canceller comprising: first and second filter sections that are provided corresponding to the first and second microphones for subjecting an audio signal supplied to the first loudspeaker to convolution calculations so as to produce first and second echo cancel signals, respectively;

third and fourth filter sections that are provided corresponding to the first and second microphones for subjecting another audio signal supplied to the second loudspeaker to convolution calculations so as to produce third and fourth echo cancel signals, respectively;

a first subtracting section that performs echo cancellation by subtracting said first and third echo cancel signals from a collected audio signal of the first microphone; and

a second subtracting section that performs echo cancellation by subtracting said second and fourth echo cancel signals from another collected audio signal of the second microphone, wherein

said stereo echo canceller further comprises a transfer function calculating section that respectively derives filter characteristics corresponding to transfer functions of said four audio transfer systems based on a cross-spectrum calculation between a

sum signal and difference signal of stereo audio signals to be reproduced by said respective loudspeakers and the collected audio signals of said respective microphones, thereby to set said derived filter characteristics to corresponding ones of said first to fourth filter sections, respectively.

12. (original) A stereo echo canceller as recited in claim 11, further comprising:

an input section that inputs said stereo audio signals;

a sum/difference signal producing section that produces said sum signal and said difference signal of the stereo audio signals inputted from said input section; and

a main signal transmission system that transmits the stereo audio signals inputted from said input section to said respective loudspeakers without passing through said sum/difference signal producing section,

wherein said transfer function calculating section derives the filter characteristics corresponding to the transfer functions of said four audio transfer systems based on the cross-spectrum calculation between the sum signal and difference signal produced by said sum/difference signal producing section and the collected audio signals of said respective microphones, and sets the derived filter characteristics to corresponding ones of said first to fourth filter sections, respectively.

13. (original) A stereo echo canceller associated to a space provided therein with two loudspeakers and two microphones for forming four audio transfer systems through which stereo sounds are reproduced by said respective loudspeakers and are collected by said respective microphones,

the canceller comprising: first and second filter sections that are provided corresponding to the first and second microphones for subjecting an audio signal

supplied to the first loudspeaker to convolution calculations so as to produce first and second echo cancel signals, respectively;

third and fourth filter sections that are provided corresponding to the first and second microphones for subjecting another audio signal supplied to the second loudspeaker to convolution calculations so as to produce third and fourth echo cancel signals, respectively;

a first subtracting section performs echo cancellation by subtracting said first and third echo cancel signals from a collected audio signal of the first microphone; and

a second subtracting section that performs echo cancellation by subtracting said second and fourth echo cancel signals from another collected audio signal of the second microphone, wherein

said stereo echo canceller further comprises a transfer function calculating section respectively derives estimated errors of transfer functions of said four audio transfer systems based on a cross-spectrum calculation between respective one of a sum signal and a difference signal of stereo audio signals to be reproduced by said respective loudspeakers and respective one of echo cancel error signals obtained by subtracting the corresponding echo cancel signals from the collected audio signals of said two microphones, thereby to update filter characteristics of said first to fourth filter sections to values that cancel said estimated errors, respectively.

14. (original) A stereo echo canceller as recited in claim 13, further comprising:

an input section that inputs said stereo audio signals;

a sum/difference signal producing section that produces said sum signal and said difference signal of the stereo audio signals inputted from said input section; and

-4-

a main signal transmission system that transmits the stereo audio signals

inputted from said input section to said respective loudspeakers without passing

through said sum/difference signal producing section,

wherein said transfer function calculating section derives the estimated errors of

the transfer functions of said four audio transfer systems based on the cross-spectrum

calculation between the sum signal and difference signal produced by said

sum/difference signal producing section and the respective echo cancel error signals,

and updates the filter characteristics of said first to fourth filter sections to the values

that cancel said estimated errors, respectively.

15. (original) A stereo echo canceller as recited in claim 13, further comprising

a correlation detecting section that detects a correlation between the sum signal and

the difference signal of said stereo audio signals, and that stops the updating of said

filter characteristics when a value of said correlation is no less than a predetermined

value.

Claims 16 – 20 (cancelled).

21. (original) A stereo sound transfer apparatus associated to two spaces each

forming said four audio transfer systems, wherein the stereo echo canceller recited in

claim 11 is arranged in each space, so that the stereo audio signals, which have been

echo-canceled by said stereo echo cancellers, are transmitted between said two

spaces.

Claims 22 - 52 (cancelled)

53. (previously presented) A multi-channel echo cancel method associated to a

space provided therein with a plurality of loudspeakers and at least one microphone for

forming a plurality of audio transfer systems,

the method comprising:

inputting multi-channel audio signals from an outside, which have a correlation with each other, and which are reproduced by said respective loudspeakers and collected by said at least one microphone through the audio transfer systems;

estimating individual transfer functions of said plurality of said audio transfer systems so as to set corresponding filter characteristics, respectively;

producing echo cancel signals respectively by applying said set filter characteristics to corresponding ones of said multi-channel audio signals to be reproduced by said respective loudspeakers; and

subtracting said echo cancel signals from corresponding individual collected audio signals of said at least one microphone, thereby performing echo cancellation,

wherein, reference signals are determined as a set of a plurality of low-correlation composite signals which correspond to signals obtained by suitably combining said multi-channel audio signals and which have a lower correlation with each other than that among said multi-channel audio signals, for deriving said individual transfer functions of the respective audio transfer systems thereby setting said corresponding filter characteristics.

54. (previously presented) A multi-channel echo cancel method as recited in claim 53, wherein calculation is conducted for respectively deriving the individual transfer functions of the respective audio transfer systems with using the set of the plurality of the low-correlation composite signals as the reference signals, such that the

calculation is based on a cross-spectrum calculation between the plurality of the low-correlation composite signals and the individual collected audio signals of the at least one microphone.

55. (previously presented) A multi-channel echo cancel method associated to a space provided therein with a plurality of loudspeakers at least one microphone for forming a plurality of audio transfer systems through which multi-channel audio signals having a correlation with each other are reproduced by said respective loudspeakers and are collected by said at least one microphone,

the method comprising: estimating individual transfer functions of said plurality of said audio transfer systems so as to set corresponding filter characteristics, respectively;

producing echo cancel signals respectively by applying said set filter characteristics to corresponding ones of said multi-channel audio signals to be reproduced by said respective loudspeakers; and

subtracting said echo cancel signals from corresponding individual collected audio signals of said at least one microphone, thereby performing echo cancellation,

wherein, reference signals are determined as a set of a plurality of low-correlation composite signals which correspond to signals obtained by suitably combining said multi-channel audio signals and which have a lower correlation with each other than that among said multi-channel audio signals, for deriving said individual transfer functions of the respective audio transfer systems, thereby setting said corresponding filter characteristics,

wherein calculation is conducted for respectively deriving the individual transfer functions of the respective audio transfer systems with using the set of the plurality of the low-correlation composite signals as the reference signals, such that the calculation is based on a cross-spectrum calculation between the plurality of the low-correlation composite signals and the individual collected audio signals of the at least one microphone, and wherein

the calculation of respectively deriving the individual transfer functions of said plurality of the audio transfer systems is performed by combining said multi-channel audio signals through arithmetic operation to produce a plurality of low-correlation composite signals having a lower correlation with each other than that among said multi-channel audio signals, deriving cross spectra by the cross-spectrum calculation between said plurality of the low-correlation composite signals and the individual collected audio signals of the at least one microphone, and ensemble-averaging each of the cross spectra in a predetermined time period for deriving the individual transfer functions of said plurality of the audio transfer systems.

56. (previously presented) A multi-channel echo cancel method associated to a space provided therein with a plurality of loudspeakers at least one microphone for forming a plurality of audio transfer systems,

the method comprising:

inputting multi-channel audio signals from an outside, which have a correlation with each other, and which are reproduced by said respective loudspeakers and collected by said at least one microphone through the audio transfer systems;

estimating individual transfer functions of said plurality of said audio transfer

systems so as to set corresponding filter characteristics, respectively;

producing echo cancel signals respectively by applying said set filter characteristics to corresponding ones of said multi-channel audio signals to be reproduced by said respective loudspeakers or a plurality of composite signals obtained by suitably combining said multi-channel audio signals; and

subtracting said echo cancel signals from corresponding individual collected audio signals of said at least one microphones, thereby performing echo cancellation,

wherein, reference signals are determined as a set of a plurality of low-correlation composite signals which correspond to signals obtained by suitably combining said multi-channel audio signals and which have a lower correlation with each other than that among said multi-channel audio signals, for deriving estimated errors of said individual transfer functions of the respective audio transfer systems or said plurality of said composite transfer functions obtained by suitably combining said individual transfer functions, thereby updating said corresponding filter characteristics to values that cancel the estimated errors.

57. (previously presented) A multi-channel echo cancel method as recited in claim 56, wherein calculation is conducted for respectively deriving the estimated errors of the individual transfer functions of the respective audio transfer systems with using the set of the plurality of the low-correlation composite signals as the reference signals, such that the calculation is based on a cross-spectrum calculation between the plurality of the low-correlation composite signals and echo cancel error signals obtained by subtracting the echo cancel signals from the corresponding individual collected audio signals of said at least one microphone.

58. (previously presented) A multi-channel echo cancel method associated to a space provided therein with a plurality of loudspeakers and at least one microphone for forming a plurality of audio transfer systems through which multi-channel audio signals having a correlation with each other are reproduced by said respective loudspeakers and are collected by said at least one microphone,

the method comprising:

estimating individual transfer functions of said plurality of said audio transfer systems so as to set corresponding filter characteristics, respectively;

producing echo cancel signals respectively by applying said set filter characteristics to corresponding ones of said multi-channel audio signals to be reproduced by said respective loudspeakers; and

subtracting said echo cancel signals from corresponding individual collected audio signals of said at least one microphone, thereby performing echo cancellation,

wherein, reference signals are determined as a set of a plurality of low-correlation composite signals which correspond to signals obtained by suitably combining said multi-channel audio signals and which have a lower correlation with each other than that among said multi-channel audio signals, for deriving estimated errors of said individual transfer functions of the respective audio transfer systems thereby updating said corresponding filter characteristics to values that cancel the estimated errors,

wherein calculation is conducted for respectively deriving the estimated errors of the individual transfer functions of the respective audio transfer systems with using the set of the plurality of the low-correlation composite signals as the reference signals,

-10-

such that the calculation is based on a cross-spectrum calculation between the plurality of the low-correlation composite signals and echo cancel error signals obtained by subtracting the echo cancel signals from the corresponding individual collected audio signals of said at least one microphone, and

wherein the calculation of respectively deriving the estimated errors of the individual transfer functions of said plurality of the audio transfer systems is performed by combining said multi-channel audio signals through an arithmetic operation to produce a plurality of low-correlation composite signals having a lower correlation with each other than that among said multi-channel audio signals, deriving cross spectra by the cross-spectrum calculation between said plurality of the low-correlation composite signals and the echo cancel error signals obtained by subtracting the echo cancel signals from the corresponding individual collected audio signals of said at least one microphone, and ensemble-averaging each of the cross spectra in a predetermined time period for deriving the estimated errors of the individual transfer functions of said plurality of the audio transfer systems.

59. (previously presented) A multi-channel echo cancel method associated to a space provided therein with a plurality of loudspeakers and at least one microphone for forming a plurality of audio transfer systems through which multi-channel audio signals having a correlation with each other are reproduced by said respective loudspeakers and are collected by said at least one microphone,

the method comprising:

estimating individual transfer functions of said plurality of said audio transfer systems so as to set corresponding filter characteristics, respectively;

-11-

producing echo cancel signals respectively by applying said set filter

characteristics to corresponding ones of said multi-channel audio signals to be

reproduced by said respective loudspeakers or; and

subtracting said echo cancel signals from corresponding individual collected

audio signals of said at least one microphone, thereby performing echo cancellation,

wherein, reference signals are determined as a set of a plurality of low-

correlation composite signals which correspond to signals obtained by suitably

combining said multi-channel audio signals and which have a lower correlation with

each other than that among said multi-channel audio signals, for deriving estimated

errors of said individual transfer functions of the respective audio transfer systems,

thereby updating said corresponding filter characteristics to values that cancel the

estimated errors, and

wherein the correlation between said plurality of said low-correlation composite

signals is detected and, when a value of said correlation is no less than a

predetermined value, the updating of said filter characteristics is suspended.

60. (previously presented) A multi-channel sound transfer method associated to

two spaces each forming said plurality of said audio transfer systems, wherein the

multi-channel echo cancel method recited in claim 53 is carried out respectively in the

two spaces, so that the multi-channel audio signals, which have been echo-canceled by

performing said method, are transmitted between said two spaces.

Claims 61 and 62 (cancelled).

63. (previously presented) A transfer function calculation apparatus being

associated to a space provided therein with a plurality of loudspeakers and at least one

microphone for forming a plurality of audio transfer systems, and being capable of

estimating individual transfer functions of said plurality of audio transfer systems, the

apparatus comprising:

an input section that inputs multi-channel audio signals from an outside, which

have a correlation with each other, and which are reproduced by said respective

loudspeakers and collected by said at least one microphone through the audio transfer

systems;

a providing section that provides reference signals as a set of a plurality of low-

correlation composite signals which correspond to signals obtained by suitably

combining said multi-channel audio signals and which have a lower correlation with

each other than that between said multi-channel audio signals; and

a calculation section that estimates the individual transfer functions of the

respective audio transfer systems based on the determined reference signals.

64. (previously presented) A transfer function calculation apparatus as recited

in claim 63, wherein the calculation section respectively derives the individual transfer

functions of the respective audio transfer systems, using as the reference signals the

set of the plurality of the low-correlation composite signals, such that calculation of

respectively deriving the individual transfer functions of the respective audio transfer

systems is based on a cross-spectrum calculation between the plurality of said low-

correlation composite signals and individual collected audio signals of the at least one

microphone.

65. (previously presented) A transfer function calculation apparatus being

associated to a space provided therein with a plurality of loudspeakers and at least one

-13-

microphone for forming a plurality of audio transfer systems through which multi-channel audio signals having a correlation with each other are reproduced by said respective loudspeakers and are collected by said microphones, and being capable of estimating individual transfer functions of said plurality of audio transfer systems, the apparatus comprising:

a providing section that provides reference signals as a set of a plurality of low-correlation composite signals which correspond to signals obtained by suitably combining said multi-channel audio signals and which have a lower correlation with each other than that between said multi-channel audio signals; and

a calculation section that estimates the individual transfer functions of the respective audio transfer systems based on the determined reference signals,

wherein the calculation section respectively derives the individual transfer functions of the respective audio transfer systems, using as the reference signals the set of the plurality of the low-correlation composite signals, such that calculation of respectively deriving the individual transfer functions of the respective audio transfer systems is based on a cross-spectrum calculation between the plurality of said low-correlation composite signals and individual collected audio signals of the at least one microphone, and

wherein the providing section combines said multi-channel audio signals through an arithmetic operation to produce said plurality of said low-correlation composite signals having a lower correlation with each other than that between said multi-channel audio signals, such that the calculation section derives cross spectra based on said cross-spectrum calculation between said plurality of said low-correlation composite

-14-

signals and the individual collected audio signals of the at least one microphone, and ensemble-averages the respective cross spectra in a predetermined time period for deriving the individual transfer functions of said plurality of said audio transfer systems.

66. (previously presented) A transfer function calculation apparatus as recited in claim 64, wherein the providing section produces a plurality of uncorrelated composite signals mutually orthogonal as the reference signals by applying a principal component analysis to said multi-channel audio signals, such that the calculation section derives cross spectra based on said cross-spectrum calculation between said plurality of said uncorrelated composite signals and the individual collected audio signals of the at least one microphone, and ensemble-averages the respective cross spectra in a predetermined time period for deriving the individual transfer functions of said plurality of said audio transfer systems.

Claims 67 – 68 (cancelled).

69. (previously presented) A multi-channel echo channel method as recited in claim 53, wherein the multi-channel audio signals being inputted from an outside and having a correlation with each other are reproduced by said respective loudspeakers without lowering the correlation of the inputted multi-channel audio signals.

70. (previously presented) A multi-channel echo cancel method as recited in claim 53, wherein the multi-channel audio signals being inputted from an outside and having a correlation with each other are provisionally modulated to lower the correlation, then demodulated to restore the correlation , and thereafter reproduced by said respective loudspeakers.

71. (previously presented) A multi-channel echo cancel method as recited in

claim 70, wherein the multi-channel audio signals are provisionally modulated to lower the correlation by one of first or second operations, the first operation adding and subtracting the multi-channel audio signals with each other, the second operation orthogonalizing the multi-channel audio signals with each other.

600327333v1